CLAIMS

1. A contactless reader/writer comprising:

a transmission section for transmitting a plurality of transmission signals using carrier waves of different frequencies;

a reception section for receiving a plurality of reply signals which are a response to a plurality of transmission signals transmitted by the transmission section;

a phase calculation section for calculating phase data of the reply signals on the basis of the reply signals; and

a distance calculation section for calculating a distance to an object having returned the reply signal, on the basis of the phase data from the phase calculation section.

2. The contactless reader/writer according to claim 1, wherein whether the object is an RF tag or an obstacle is determined on the basis of whether data is contained in the reply signal or not.

3. The contactless reader/writer according to claim 1, wherein the transmission section is an array antenna.

4. The contactless reader/writer according to claim 1, wherein the transmission section comprises an antenna section having directivity and an antenna driving section for moving

the antenna section.

5. The contactless reader/writer according to claim 1, further comprising a control section for controlling a transmission direction of the transmission signals transmitted from the transmission section,

wherein the control section calculates the position of the object on the basis of the transmission direction and the calculation result of the distance calculation section, whereby on the basis of the calculated position of the object and the transmission direction of the transmission signals from the transmission section, the transmission direction of the transmission signals from the transmission section is directed to the position of the object.

6. The contactless reader/writer according to claim 1, further comprising a control section for performing gain control for the transmission signals transmitted from the transmission section on the basis of the calculation result of the distance calculation section.

7. The contactless reader/writer according to claim 1, further comprising a control section for controlling a transmission direction of the transmission signals transmitted from the transmission section,

wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby gain control for the transmission signals transmitted from the transmission section is performed on the basis of the positions of a plurality of the objects.

8. The contactless reader/writer according to claim 1, further comprising a control section for controlling a transmission direction of the transmission signals transmitted from the transmission section,

wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby wavelength control for the transmission signals transmitted from the transmission section is performed on the basis of the positions of a plurality of the objects.

9. The contactless reader/writer according to claim 1, further comprising a display section for displaying position information and/or speed information of an object.

10. The contactless reader/writer according to claim 1, further comprising a sound output section for outputting position information and/or speed information of an object with

sound.

11. A contactless reader/writer comprising:

a transmission section for transmitting a plurality of transmission signals using carrier waves of different frequencies;

a reception section for receiving a plurality of reply signals which are a response to a plurality of transmission signals transmitted by the transmission section;

a phase calculation section for calculating phase data of the reply signals on the basis of the reply signals; and

a speed calculation section for calculating a frequency component of baseband signals on the basis of the baseband signals acquired from the received signal, and thereby calculating a traveling speed of an object having returned the reply signal on the basis of the frequency component.

12. The contactless reader/writer according to claim 11, wherein whether the object is an RF tag or an obstacle is determined on the basis of whether data is contained in the reply signal or not.

13. The contactless reader/writer according to claim 11, wherein the transmission section is an array antenna.

14. The contactless reader/writer according to claim 11, wherein the transmission section comprises an antenna section having directivity and an antenna driving section for moving the antenna section.

15. The contactless reader/writer according to claim 11, further comprising a display section for displaying position information and/or speed information of an object.

16. The contactless reader/writer according to claim 11, further comprising a sound output section for outputting position information and/or speed information of an object with sound.

17. A contactless reader/writer comprising:

a transmission section for transmitting a plurality of transmission signals using carrier waves of different frequencies;

a reception section for receiving a plurality of reply signals which are a response to a plurality of transmission signals transmitted by the transmission section;

a phase calculation section for calculating phase data of the reply signals on the basis of the reply signals;

a distance calculation section for calculating a distance to an object having returned the reply signal, on the basis

of the phase data from the phase calculation section and/or a speed calculation section for calculating a frequency component of baseband signals on the basis of the baseband signals acquired from the received signal, and thereby calculating a traveling speed of an object having returned the reply signal on the basis of the frequency component; and

a control section for controlling a transmission direction of the transmission signals transmitted from the transmission section.

18. The contactless reader/writer according to claim 17, wherein the control section calculates the position of the object on the basis of the transmission direction and the calculation results of the distance calculation section and/or the speed calculation section.

19. The contactless reader/writer according to claim 17, wherein the transmission section is an array antenna.

20. The contactless reader/writer according to claim 17, wherein the transmission section comprises an antenna section having directivity and an antenna driving section for moving the antenna section.

21. The contactless reader/writer according to claim 17,

wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby a modulation method for the transmission signals transmitted from the transmission section is changed on the basis of the positions of a plurality of the objects and/or the speeds of a plurality of the objects.

22. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby a packet size of the transmission signals transmitted from the transmission section is changed on the basis of the positions of a plurality of the objects and/or the speeds of a plurality of the objects.

23. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby a coding method for the transmission signals transmitted from the transmission section is changed on the basis of the positions of a plurality of the objects and/or the speeds of a plurality of the objects.

24. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, and after that a transmission signal is transmitted to a desired object so that communication is performed with the object.

25. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby a reply signal from an object in a desired position is validated.

26. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby communication with objects is stopped when no object is present within a desired area.

27. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby a

transmission signal is transmitted to an object moving at a desired speed so that communication is performed.

28. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby a reply signal from an object moving at a desired speed is validated.

29. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby communication is stopped when no object is moving at a desired speed.

30. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby communication is performed solely with an object present within a desired area and moving at a desired speed.

31. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated

on the basis of the transmission direction and the calculation result of the distance calculation section, whereby a reply signal from an object present within a desired area and moving at a desired speed is validated.

32. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby communication is stopped when no object is present within a desired area or when no object is moving at a desired speed.

33. The contactless reader/writer according to claim 17, wherein positions of a plurality of the objects are calculated on the basis of the transmission direction and the calculation result of the distance calculation section, whereby communication is performed sequentially starting with one having the nearest distance among a plurality of the objects, or alternatively communication is performed sequentially starting with one having the farthest distance.

34. The contactless reader/writer according to claim 17, further comprising a display section for displaying position information and/or speed information of an object.

35. The contactless reader/writer according to claim 17, further comprising a sound output section for outputting position information and/or speed information of an object with sound.

36. A contactless reader/writer comprising:

a transmission section for transmitting a plurality of transmission signals using carrier waves of different frequencies;

a reception section for receiving a plurality of reply signals which are a response to a plurality of transmission signals transmitted by the transmission section;

a phase separation section for separating a phase component from each of a plurality of the received signals; and

a distance calculation section for calculating a distance to an object having returned the reply signals, on the basis of the phase components of a plurality of received signals separated by the phase separation section.

37. A contactless reader/writer comprising:

a transmission section for transmitting a plurality of transmission signals using carrier waves of different frequencies;

a reception section for receiving a plurality of reply

signals which are a response to a plurality of transmission signals transmitted by the transmission section;

a phase separation section for separating a phase component from each of a plurality of the received signals; and

a speed calculation section for calculating a frequency component of baseband signals on the basis of the baseband signals acquired from the received signal, and thereby calculating a traveling speed of an object having returned the reply signals on the basis of the frequency component.

38. A contactless reader/writer comprising:

a transmission section for transmitting a plurality of transmission signals using carrier waves of different frequencies;

a reception section for receiving a plurality of reply signals which are a response to a plurality of transmission signals transmitted by the transmission section;

a phase calculation section for calculating phase data of the reply signals on the basis of the reply signals;

a data extraction section for receiving an output of the phase calculation section; and

a distance calculation section for calculating a distance to an object having returned the reply signal, on the basis of the output data of the phase calculation section and a phase

detection signal outputted from the data extraction section.

39. A contactless reader/writer comprising:

a transmission section for transmitting a plurality of transmission signals using carrier waves of different frequencies;

a reception section for receiving a plurality of reply signals which are a response to a plurality of transmission signals transmitted by the transmission section;

a phase calculation section for calculating phase data of the reply signals on the basis of the reply signals;

a data extraction section for receiving an output of the phase calculation section; and

a speed calculation section for calculating a frequency component of baseband signals on the basis of the baseband signals acquired from the received signal, and thereby calculating a traveling speed of an object having returned the reply signal on the basis of the frequency component.

40. A contactless reader/writer comprising:

a transmission section for transmitting one transmission signal in which a carrier frequency is continuously changed as a function of time;

a reception section for receiving a reply signal which is a response to the transmission signal transmitted by the

transmission section; and

a distance calculation section for calculating a frequency component of baseband signals on the basis of the baseband signals acquired from the received signal, then calculating a difference frequency between a frequency of the transmission signal and a frequency of the received signal on the basis of the frequency component, and thereby calculating a distance to an object having returned the reply signal on the basis of the difference frequency component.

41. A contactless reader/writer comprising:

a transmission section for transmitting one transmission signal in which a carrier frequency is continuously changed as a function of time;

a reception section for receiving a reply signal which is a response to the transmission signal transmitted by the transmission section; and

a speed calculation section for calculating a frequency component of baseband signals on the basis of the baseband signals acquired from the received signal, then calculating a difference frequency between a frequency of the transmission signal and a frequency of the received signal on the basis of the frequency component, and thereby calculating a traveling speed of an object having returned the reply signal on the basis of the difference frequency component.